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# A PRELIMINARY HISTOLOGICAL ANALYSIS OF NECROSIS APPARENTLY ASSOCIATED WITH MATSUCOCCUS SCALE ON PONDEROSA PINE

JMM
KAS
JEP
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by
H. L. McKenzie
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# A PRELIMINARY HISTOLOGICAL ANALYSIS OF NECROSIS APPARENTLY ASSOCIATED WITH MATSUCOCCUS SCALE ON PONDEROSA PINE

## Introduction

In a report submitted on December 20, 1937 by Mr. J. M. Miller and the author mention was made of the apparent necrosis that seems to occur beneath, and in the immediate vicinity of, Matsucoccus scale on ponderosa pine. The apparent cell disintegration was first observed during the period of the second stage of development of the Matsucoccus scale, and appeared to be much more pronounced where there was an aggregation of feeding scale.

From the limited amount of material sectioned thus far it appears that the necrotic areas have extended only slightly as the season has progressed. However, this slight extension of necrosis may not truly represent what actually happens to those twigs that ultimately flag because there is every reason to believe that the method of sampling may be at fault. For instance, the manner in which the wood samples were selected was simply to cut blocks where an aggregation of feeding Matsucoccus scale was in evidence on the internode. These samples were taken from not only the current years growth, but also from those internodes two, three and even four years old. Now since it is impossible, at least at the present time, to say just where the lesion that ultimately kills a branch will occur, it is very probable that many of the wood samples collected thus far will show necrosis extending only just so far and no further. At the suggestion of Dr. F. C. Craighead samples collected henceforth will be chosen from branches that have been carefully sliced on one side, and only those showing partial lesions or full lesions will be preserved. Consequently, it should be possible to more accurately note any progression of necrosis that might take place throughout the season, and the results should not be so erratic. Furthermore the wood blocks will not be imbedded in paraffin for serial sections, but instead gross cross sections will be cut unless there are cases where a more critical analysis is desired.

It is yet to be proven whether or not this type of injury will ultimately develop into flagging, and although the spring period has not as yet been covered by the histological studies now under way, it seems appropriate to make available the information now at hand.

Scale Feeding

Very little published work is available with regard to the specific effects of the attacks of sucking insects upon the tissues of their hosts. There are but few published records of morphological and chemical study of the affected plant tissue and of histological studies of the parts of the insect that we are concerned with, namely the stylets.

On the basis of histological preparations at hand, it appears that the stylets or feeding mouthparts of the insect apparently terminate in storage cells of the cortex area ( a photo-micrograph of this is shown at the conclusion of this report) (Photo 1). Of the many hundreds of histological sections made, this one only shows the apparent termination of the stylets into a large cortex storage cell. Other preparations are at hand that show the stylets penetrated into the epidermal cells (Photo 2) and may cases are to be found where they have reached the old cortex area being apparently cut off beyond this point by mechanical means and not being recovered again in sections of the same series. (PHoto 3). Apparently the contents of these storage cells are concentrated sugars and mucilage, and one would assume that this food would be a highly desirable one for developing scale insects. It also appears that where the stylets have pierced through a cell there has been a coagulating substance formed around the stylet sheath (Phote 3) and this substance is believed by some authors to be produced by the saliva of the insect and by other authors it is believed to be formed by the cell as a protective function. It is difficult to arrive at any definite conclusion in regard to this matter without initiating micro-chemical analysis.

Necrosis

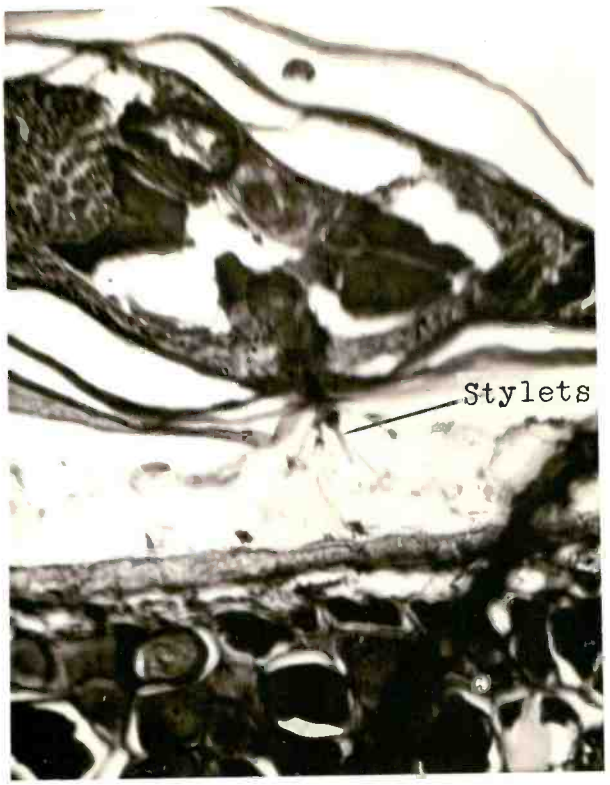
It has been repeatedly observed that if one will carefully cut beneath an aggregation of feeding Matsucoccus scale on ponderosa pine even where the scale have settled near the node on the current years growth, there will usually be a brown spot in evidence. Furthermore, if one will repeat this operation on a normal current years growth near the node no such spot will exist unless some abrasion has previously taken place, and as will be seen in Photo 4 (showing normal current years growth) the formation of natural bark-plate tissue has not been greatly produced such as is the case of the necrosis beneath the feeding scale. The consistancy of these spots associated with an aggregation of feeding Matsucoccus scale cannot be ignored. The obvious pertinent questions are, did a sufficient amount of tissue die before winter to assure the death of the branches next spring, or will the decomposition process proceed repidly later in the spring?

Necrosis - continued

An examination of necrotic areas formed in association with Matsucoccus scale indicates an apparent internal break-down of cell contents as well as cell wall disintegration. (Photo 5). The specimens here photographed were collected during September 1937 and at that time the necrosis had not apparently extended far enough to include the active phloem cells or cambium. It will be further observed from the histological preparations at hand that the stylets usually project beyond this necrosis, which would lead one to believe that at least during the early stages of development there may be some toxic or enzymatic action that takes place. This idea is, however, without fundamental evidence and will require micro-chemical analysis to determine it.

Howard L. McKenzie
Assistant Entomologist

Photo 1 (10068 I and J). Photomicrograph of stylets or mouthparts of Matsucoccus sp. scale apparently terminating in a large cortex storage cell of ponderosa pine. Such cells are apparently rich in concentrated sugars and mucilage, and one would assume that this food would supply sufficient nurishment for growing scale. The black pointers indicate position of stylets passing through two large cortex storage cells and apparently finally terminating in a rather elongate darkened storage cell.




Phote 2 (10068 L). Photomicrograph of Matsucoccus sp. stylets penetrating the epidermal cells of ponderosa pine. In this case the stylets remained intact with the body of the insect during the preparation of the section.

Photo 3 (10068 D). Photomicrograph of Matsucoccus sp. stylets penetrating through the epidermal cells and passing through cells of the old cortex area of ponderosa pine. It appears that the stylets have been pulled out of a cortex cell as is evidenced by the coagulating substance formed around the stylet sheath. This substance may be the result of salivary action as caused by the insect or by the cells themselves as a protective function.

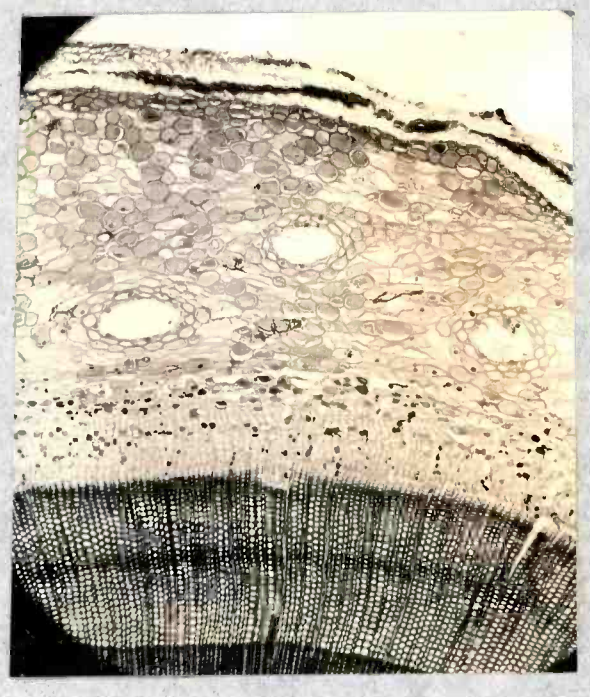
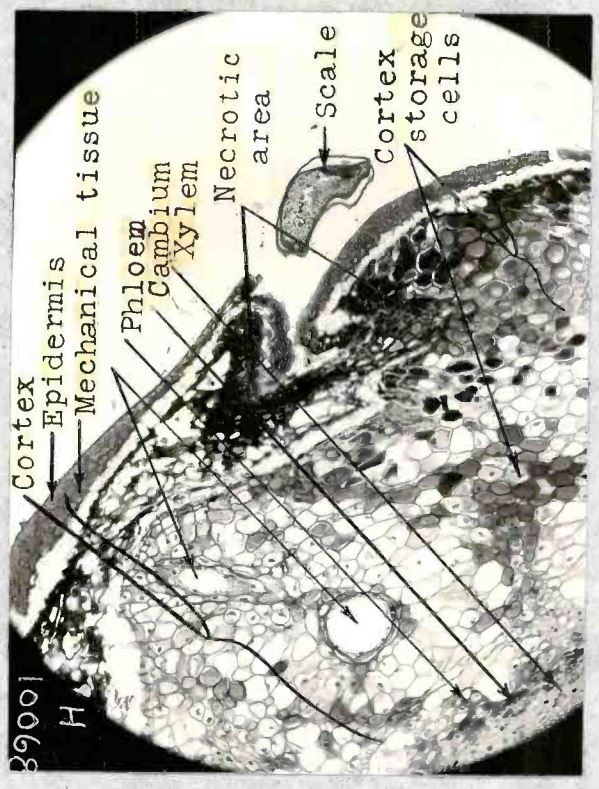


Photo 4 (10068 X). Normal current years growth of ponderosa pine. Note particularly that the formation of natural bark-plate tissue is not greatly produced and therefore is easily differentiated from necrosis beneath feeding scale.



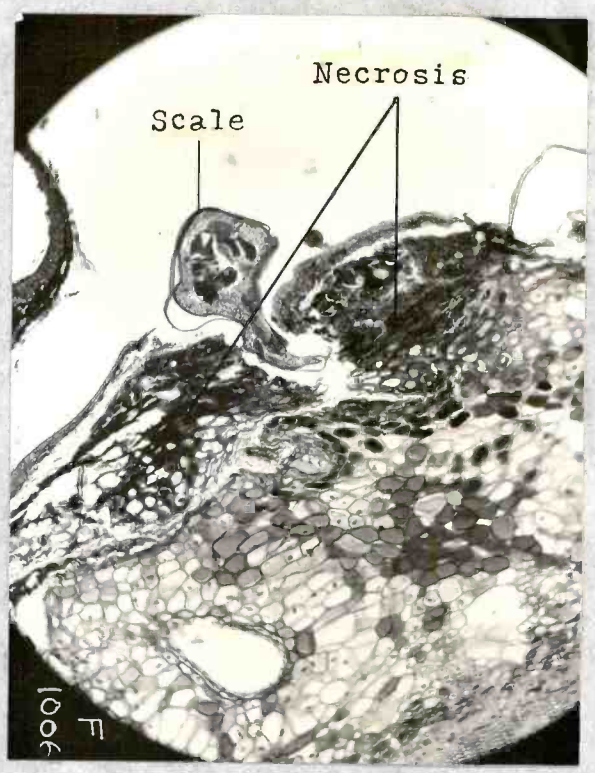




Photo 5 (10068 F and H). Photomicrographs of two histological sections taken from the same serial series. Note particularly the darkened necrotic areas beneath and in the immediate vicinity of the Matsucoccus scale. This material was collected on September 24, 1937 and represants scale on current years growth.